



U.S. Department of Energy  
Energy Efficiency and Renewable Energy

# DOE SSL Commercial Product Testing Program (CPTP)

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Voices for SSL Efficiency: DOE SSL Workshop  
Pasadena



# Outline: Commercial Product Testing Program

- Purposes of CPTP
- Testing program scope
- Methods & process
- Progress to date
- Round 1 results
- Where to go for more info



# Purposes of CPTP

- Provide objective, high quality performance information
- Know performance of market available products
  - To support R & D planning
  - To support ENERGY STAR
- Inform industry test procedures and standards development
- Discourage low quality products
- Reduce SSL market risk due to buyer dissatisfaction from products that do not perform as claimed



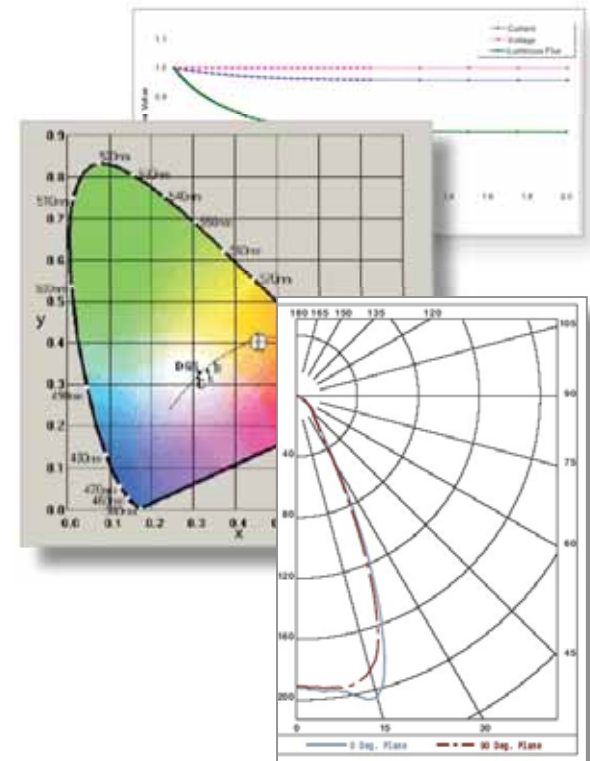
**YOU MAY NEVER CHANGE  
ANOTHER LIGHT BULB**

- ✓ *Long life*
- ✓ *Energy efficient*
- ✓ *Easy to install (standard socket)*
- ✓ *Natural white, superb color rendering*



# Testing Program Scope

- Commercially-available SSL products for the general illumination market
  - Luminaires (white light)
  - Indoor and outdoor
  - Residential and commercial
- Testing for
  - Luminaire light output, efficacy
  - Power, thermal characteristics
  - Beam and intensity
  - Lumen depreciation
  - Spectral power distribution, CCT, CRI
  - Benchmarking (other light sources)





# Testing Program Process

- Quarterly product selection & acquisition
- Multiple independent test labs
- Assembly and analysis of results
  - Courtesy sharing of results with manufacturers
  - Retesting options
- Publication of results
  - Summary reports
  - Detailed test reports
- “No Commercial Use” Policy



Photo credit: Luminaire Testing Laboratory



# Progress to Date

- Quarterly rounds of testing
  - Selection → Acquisition → Testing → Analysis → Reports
- Current Status
  - Pilot testing completed
  - Round 1 completed
  - Round 2 testing underway
  - Round 3 products under selection and acquisition

The screenshot shows a web browser window displaying the DOE SSL Commercial Product Testing Program website. The page has a green header with the text "Building Technologies Program" and "Solid-state Lighting". Below the header, there is a sidebar on the left with a list of links: "Why Invest in SSL?", "SSL Portfolio", "SSL Partnership", "SSL Project Portfolio", "Current SSL Projects", "Completed SSL Projects", "Commercial Product Testing Program", "Standardized Measurement", "Using LEDs for General Illumination", "LED Basics", "Energy Efficiency", "Color Quality", "LED Life", "Thermal Management", "LED Applications", "Research Funding", and "Sign up for RSS". The main content area is titled "DOE SSL Commercial Product Testing Program" and "REQUEST FOR DETAILED TEST REPORT". It asks the user to "Please provide the following information:" and includes fields for "First Name\*", "Last Name\*", "Organization\*", "Email\*", and "Phone\*". Below these fields, there is a section titled "Select the report(s) that you would like to receive," with checkboxes for "00-11 Task/Book", "00-06 Surface mount", "00-01 Outdoor area", "00-04 Task", "00-02 Downlight", "00-02 Undercabinet (update)", and "00-01 Downlight". At the bottom, there is a checkbox for "Yes, I agree to abide by the DOE SSL Commercial Product Testing Program NO COMMERCIAL USE POLICY" and a "Submit" button.



# CPTP Round 1 Results

- 12 products tested
- Focus: overall luminaire performance
- Wide range in products & results
- Small sample size, more testing Round 2





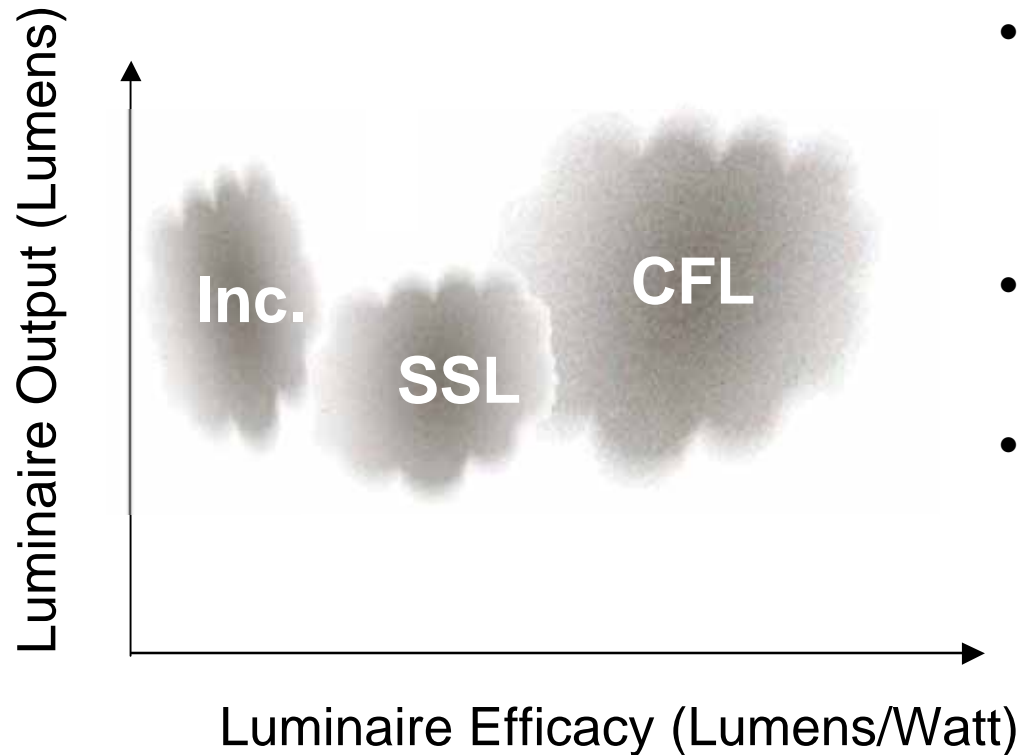
# Examples of CPTP Results

|  | <i>Manufacturer<br/>Published LED<br/>Luminous<br/>Efficacy</i> | <b>Light Output<br/>(lumens)</b> | <b>Luminaire<br/>Efficacy<br/>(lm/W)</b> | <b>Correlated Color<br/>Temperature<br/>(K)</b> | <b>Color Rendering<br/>Index</b> |
|--|---|----------------------------------|--|---|----------------------------------|
| <b>SSL Downlights</b>  |   |                                  |  |   |                                  |
| <b>CPTP 06-01</b>  | <i>40 lm/W</i>  | 193                              | 12.8                                     | 3012  | 70                               |
| <b>CPTP 06-03</b>  | <i>45 lm/W</i>  | 298                              | 19.4                                     | 2724  | 67.3                             |
| <b>SSL Undercabinets</b>   |   |                                  |  |   |                                  |
| <b>CPTP 06-02</b>  | <i>55 lm/W</i>  | 166                              | 16.1                                     | 3483  | 78.2                             |
| <b>CPTP 06-08</b>  |   | 375                              | 21.6                                     | 7003  | 72.3                             |
| <b>CPTP 06-10</b>  |   | 166                              | 32.8 [21.9]                              | 4103  | 77.3                             |
| <b>SSL Task/Desk Lights</b>  |   |                                  |  |   |                                  |
| <b>CPTP 06-04</b>  | <i>36 lm/W</i>  | 114                              | 11.6 [7.1]                               | 6392  | 76                               |
| <b>CPTP 06-09</b>  |   | 328                              | 15.3 [11.6]                              | 3841  | 84.9                             |
| <b>CPTP 06-11</b>  |   | 215                              | 17.0 [8.2]                               | 5973  | 74                               |
| <b>CPTP 07-03</b>  |   | 226                              | 18.4 [8.6]                               | 5939  | 74                               |
| Adjusted efficacy values in brackets [] include the effect of measured off-state power consumption assuming 3 hours on-time per day. |   |                                  |  |   |                                  |





# Energy Use and Light Output



## General Observations

- Luminaire outputs: comparable for some applications
  - Undercabinets
  - Desk/Task
- Luminaire efficacies
  - SSL surpasses incandescent
  - SSL  $\rightarrow$   $\frac{1}{2}$  to  $\frac{3}{4}$  CFL
- Caution:
  - Small sample size
  - SSL evolving
  - More benchmarking
  - More testing



# Direct CFL/LED Comparison

- Same desk/task light, two different sources

|                           | CFL  | LED  |
|---------------------------|------|------|
| Luminaire Output (lm)     | 236  | 226  |
| Luminaire Efficacy (lm/W) | 24.2 | 18.4 |
| CCT                       | 3432 | 5939 |
| CRI                       | 79   | 74   |
| Power Factor              | 0.54 | 0.92 |



# Off-State Power Concern

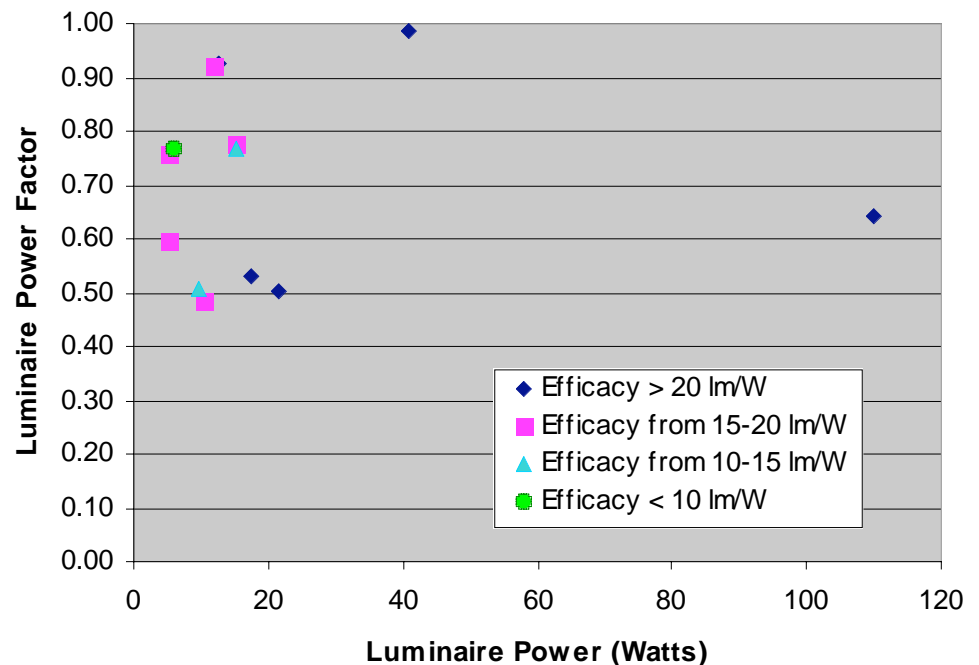
- Luminaires with on-off switches
  - 18 lm/W  $\rightarrow$  9 lm/W (for 3 hours on per day)

| Table 2. Effective Average Efficacy   |     |                                      |                                 |                                   |                    |                    |
|---|-----|--------------------------------------|---------------------------------|-----------------------------------|--------------------|--------------------|
|   |     | Measured Efficacy w/ Power On (lm/W) | Measured Power in Off State (W) | Effective Average Efficacy (lm/W) |                    |                    |
|   |     |                                      |                                 | 1 hour on per day                 | 3 hours on per day | 5 hours on per day |
| CPTP 06-04 Task Light   |     | 11.6                                 | 0.88                            | 3.8                               | 7.1                | 8.7                |
| CPTP 06-09 Task/Desk  |     | 15.3                                 | 0.98                            | 7.4                               | 11.6               | 13.0               |
| CPTP 06-10 Undercabinet   |     | 32.8                                 | 0.36                            | 12.4                              | 21.9               | 25.8               |
| CPTP 06-11 Task/Desk  |     | 17.0                                 | 1.96                            | 3.7                               | 8.2                | 10.7               |
| CPTP 07-02 Task/Desk  | CFL | 24.2                                 | 1.14                            | 6.6                               | 13.3               | 16.8               |
| CPTP 07-03 Task/Desk  | LED | 18.4                                 | 2.00                            | 3.9                               | 8.6                | 11.4               |
| Note that units operated for fewer hours per year will consume less energy, despite lower efficacies. |     |                                      |                                 |                                   |                    |                    |



# Round 1 Results: Power Factors

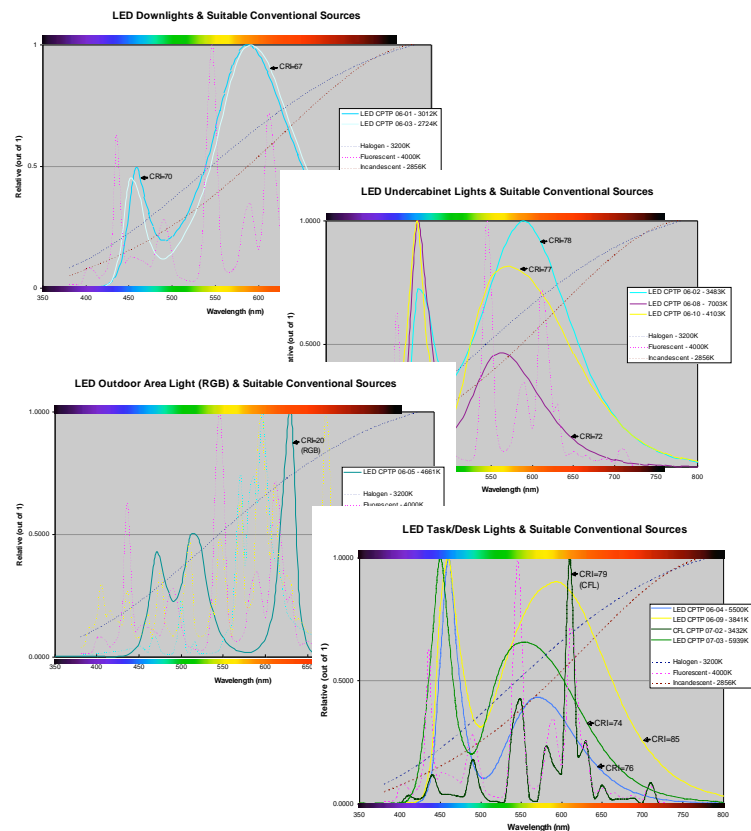
- Range of values
  - 0.5 to 1.0
- Small sample size for now
  - No PF/efficacy correlation
  - No PF/power correlation





# Round 1 Results: Color Qualities

- Range of color qualities
  - CCT range: 2724 K to 7003 K
  - Phosphor-conversion LEDs CRI range: 67-85
  - One RGB luminaire tested

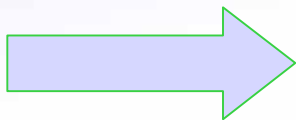




# CPTP Round 1 Key Conclusions

- Wide range of performance in SSL luminaires
  - Misleading product literature
- CPTP positive influences
  - Market/industry awareness & involvement
  - Testing standards validation & refinement

Round 1 products designed in 2005-2006, showing some LED luminaires rivaling some CFL luminaires in output and efficacy



Great promise for next generation  
of commercially available SSL luminaires



# More Info on CPTP

- Via website
  - Summary reports
  - Detailed reports
    - Must be requested via web form
    - Requestor's contact information must be provided
    - Must agree to adhere to 'No Commercial Use Policy'



[http://www.netl.doe.gov/ssl/comm\\_testing.htm](http://www.netl.doe.gov/ssl/comm_testing.htm)



# THANK YOU





# No Commercial Use Policy

The U.S. Department of Energy (DOE) is a federal agency working in the public interest. Published information from the DOE SSL Commercial Product Testing Program, including test reports, technical information, and summaries, is intended solely for the benefit of the public, in order to help buyers, specifiers of new SSL products, testing laboratories, energy experts, energy program managers, regulators, and others make informed choices and decisions about SSL products and related technologies. **Such information may not be used in advertising, to promote a company's product or service, or to characterize a competitor's product or service.** This policy precludes any commercial use of any DOE SSL Commercial Product Testing Program published information in any form without DOE's express written permission.